Girraween High School

Year 11 Mathematics Extension 1

2025 Yearly Examination

Student Number _____

Question	Mark	ME11-1	ME11-2	ME11-3	ME11-5	MA11-7
1	/1	✓	✓			✓
2	/1	✓				✓
3	/1	✓				✓
4	/1			✓		✓
5	/1	✓	✓			✓
6	/16	✓	✓			✓
7a	/3	✓	✓			✓
7b	/6	✓	✓			✓
7c	/3	✓	✓			✓
7d	/2	✓	✓			✓
8	/13				✓	✓
9	/13				✓	✓
10	/14			✓		✓
11	/13			✓		✓
Total	**/88**	**/34**	**/32**	**/28**	**/26**	**/88**

Year 11 Mathematics Extension 1 outcomes

A student:

ME11-1 uses algebraic and graphical concepts in the modelling and solving of problems involving functions and their inverses

ME11-2 manipulates algebraic expressions and graphical functions to solve problems

ME11-3 applies concepts and techniques of inverse trigonometric functions and simplifying expressions involving compound angles in the solution of problems

ME11-4 applies understanding of the concept of a derivative in the solution of problems, including rates of change, exponential growth and decay and related rates of change

ME11-5 uses concepts of permutations and combinations to solve problems involving counting or ordering

ME11-6 uses appropriate technology to investigate, organise and interpret information to solve problems in a range of contexts

ME11-7 communicates making comprehensive use of mathematical language, notation, diagrams and graphs

2025 Year 11 Yearly Examination
Mathematics Extension 1
Multiple Choice Answer Sheet

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

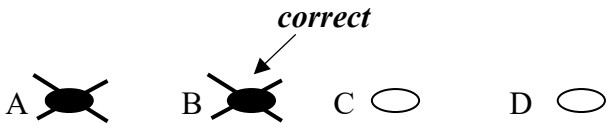
Sample $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

A ⬭ B ⬬ C ⬭ D ⬭

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.



If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word ***correct*** and drawing an arrow as follows.



1.	A	○	B	○	C	○	D ○
2.	A	○	B	○	C	○	D ○
3.	A	○	B	○	C	○	D ○
4.	A	○	B	○	C	○	D ○
5.	A	○	B	○	C	○	D ○

Girraween High School

2025 Year 11 Yearly Examination

Mathematics Extension 1

General Instructions

- Reading time: 10 minutes
- Working time: 120 minutes
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided
- Answer multiple-choice questions on the multiple-choice answer sheet provided
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total Marks:

<u>Section I</u> 5 Marks

- Attempt Questions 1 -5
- Allow about 10 minutes for this section

<u>Section II</u> 83 Marks

- Attempt Questions 6 - 11
- Allow about 110 minutes for this section

Section I

5 marks
Attempt Questions 1 – 5
Allow about 10 minutes for this section
Use the multiple-choice answer sheet for Questions 1 – 5

Question 1

The curve $y = 2x^{\frac{1}{3}}$ is reflected in the line $y = x$.

What is the equation of the reflected curve?

A) $y = \frac{x^3}{16}$

B) $y = \frac{x^3}{8}$

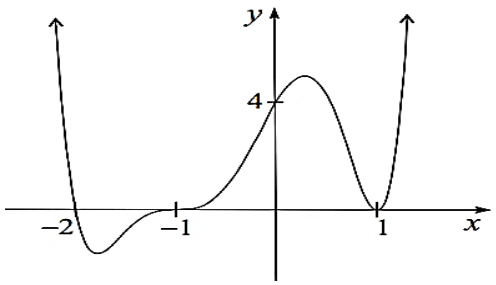
C) $y = \frac{x^3}{4}$

D) $y = \frac{x^3}{2}$

Question 2

The diagram below shows the graph of $y = a(x + b)(x + c)^2 (x + d)^3$.

What are the possible values of *a, b, c* and *d* ?



A) $a = 1, b = 1, c = -2, d = -1$

B) $a = 1, b = 2, c = -1, d = 1$

C) $a = 2, b = 2, c = -1, d = 1$

D) $a = 2, b = 2, c = 1, d = -1$

Examination continues next page…

Question 3

For what values of k does the polynomial $P(x) = (k^3 - k)x^4 + (k^2 - k)x^3 + x^2$ have degree 3?

A) $k = -1$

B) $k = -1$ or $k = 0$

C) $k = -1$ or $k = 1$

D) $k = -1, k = 0$ or $k = 1$

Question 4

Evaluate $\sin 25°\cos 20° + \cos 25° \sin 20°$.

A) $\frac{1}{\sqrt{2}}$

B) 2

C) $\frac{1}{2}$

D) $\sqrt{2}$

Question 5

A function is defined by $f(x) = -\sqrt{4 - x^2}$ for $0 \leq x \leq 2$.

Which of the following represents the inverse function of $f(x)$?

A) $f^{-1}(x) = -\sqrt{4 - x^2}$ for $0 \leq x \leq 2$

B) $f^{-1}(x) = \sqrt{4 - x^2}$ for $0 \leq x \leq 2$

C) $f^{-1}(x) = -\sqrt{4 - x^2}$ for $-2 \leq x \leq 0$

D) $f^{-1}(x) = \sqrt{4 - x^2}$ for $-2 \leq x \leq 0$

Examination continues next page…

Section II

83 marks
Attempt Questions 6 - 11
Allow about 110 minutes for this section

Answer each question in the appropriate writing booklet. Extra writing booklets are available.

For questions in Section II, your responses should include relevant mathematical reasoning and/or calculations.

Question 6 (16 marks) [START A NEW PAGE]

a) Consider the function $P(x) = x^4 - x^3 + x^2 - 3x - 6$.

i. Show that $x = -1$ and $x = 2$ are both zeros of $P(x)$. **2**

ii. Factorise $P(x)$ completely. **3**

iii. Sketch the graph of $y = P(x)$ showing x-intercepts and y-intercepts. **1**

iv. Hence, solve the inequality $x^4 - x^3 + x^2 - 3x - 6 < 0$. **1**

b) If α, β, γ are the roots of $2x^3 - 5x - 3 = 0$, find the values of

i. $\alpha + \beta + \gamma$ **1**

ii. $\alpha\beta + \alpha\gamma + \beta\gamma$ **1**

iii. $\dfrac{1}{\alpha^2 + \beta^2 + \gamma^2}$ **2**

c) A polynomial $P(x)$ has a remainder of $2x + 1$ when divided by $x^2 - 5x + 6$. **2**
What is the remainder when $P(x)$ is divided by $x - 3$?

d) A polynomial $P(x)$of degree 4 has a double zero at $x = 2$ with the other two zeros being *k* and -*k*. When $x = 1$, $P(x)$ takes the value 8 and when $x = 3$, $P(x)$ takes the value 80. Find the possible values of *k*. **3**

Examination continues next page…

Question 7 (14 marks) [START A NEW PAGE]

a) Solve for x: $\frac{2x}{1-x} \geq x$. **3**

b) Consider the function $f(x) = x^2 - 2$, in the domain $0 \leq x \leq 4$.

i. Find the inverse function $f^{-1}(x)$ and state its domain. **3**

ii. On the same diagram sketch the graphs of the function $f(x)$ and the inverse function $f^{-1}(x)$ showing the coordinates of the endpoints, point of intersection and the intercepts on the axes. **3**

c) If $f(x) = x^2 - 1$, sketch the graph of $y = \frac{1}{f(x)}$ labelling all intercepts and asymptotes. **3**

d) A function is defined parametrically by: **2**

$x = 5\cos(2t) + 1$ and $y = 5\sin(2t) - 1$.

Find the Cartesian equation of this curve.

Examination continues next page…

Question 8 (13 marks) [START A NEW PAGE]

a) A picnic is arranged for 4 adults and 4 children at the zoo.

In how many ways can:

i. they queue in a line to get in? **1**

ii. they sit around a circular picnic table if the children and the adults alternate? **2**

iii. each adult pairs up with a child to catch the cable car down to the ferry? **1**

b) A committee of 5 people are to be chosen from a group of 6 men and 5 women.

In how many ways can they be chosen if :

i. there are no restrictions. **1**

ii. a majority of men is on the committee. **2**

c) There are two identical black marbles and four identical white marbles arranged in a row.

i. How many different arrangements are possible? **1**

ii. How many different arrangements of just four of these marbles are possible? **2**

d) There are n seats around a circular table and n people need to be arranged around the table.

i. In how many ways can the people be arranged? **1**

ii. Find the probability, in terms of n, of three particular people sitting together. **2**

Give your answer in simplest form.

Examination continues next page…

Question 9 (13 marks) [START A NEW PAGE]

a) Ten members of a sporting team have the numbers 1 to 10 on the back of their jumpers. What is the minimum number of players that need to be chosen to ensure that at least one pair of players have numbers that add to 12? Explain your answer. **2**

b) Expand the expression $(2a - b)^4$. **2**

c) Find as a rational number, the coefficient of x in the expansion of $\left(x^2 + \frac{1}{2x}\right)^8$. **3**

d) i. Write down the binomial expansion of $(1 + x)^n$. **1**

ii. Hence, show that $\binom{n}{0} + \binom{n}{2} + \binom{n}{4} + \ldots = \binom{n}{1} + \binom{n}{3} + \binom{n}{5} + \ldots$ **2**

e) In the expansion of $(1 + 2x)^n$, the ratio of the coefficient of the term in x^4 to that of the term in x^6 is $5 : 8$. Find the value of n. **3**

Examination continues next page…

Question 10 (14 marks) [START A NEW PAGE]

a) Show that $\sin 75° = \frac{1+\sqrt{3}}{2\sqrt{2}}$. **2**

b) Given that $t = \tan\frac{\theta}{2}$, show that $\frac{\sin\theta}{1+\cos\theta} = t$. **2**

c) Prove the identity:

$\frac{\cos x - \cos(x+2y)}{2\sin y} = \sin(x+y)$ **3**

d) Using the double angle formulae, prove the identity: **3**

$\sin 3\theta = 3\sin\theta - 4\sin^3\theta$.

e) i. Show that $(a+b)(a^2-ab+b^2) = a^3+b^3$. **1**

ii. Hence, prove that $\cos^6\theta + \sin^6\theta = \frac{1}{4} + \frac{3\cos^2 2\theta}{4}$. **3**

Examination continues next page…

Question 11 (13 marks) [START A NEW PAGE]

a) Prove that $\frac{\sin 2A}{\sin A} - \frac{\cos 2A}{\cos A} = \sec A$. **3**

b) If $\tan A$ and $\tan B$ are the roots of the equation $4x^2 - 3x - 3 = 0$, find the value of $\tan(A + B)$. **3**

c) If $\cos A = \frac{7}{9}$ and $\sin B = \frac{1}{3}$ where $0 \leq A \leq 90°$ and $0 \leq B \leq 90°$. **2**

Show that $A = 2B$.

d) Given that $\cos 2\theta = -2\sin^2\theta - \sin 2\theta$, find the value of $\tan\theta$. **3**

e) Use the product to sums results to show that: **2**

$4\cos 4x \cos 2x \cos x = \cos 7x + \cos 5x + cos3x + \cos x$.

End of Examination.

Mathematics Assessment Solutions

Girraween High School

☑ Year 11	☑ Extension 1	Year 2025
☐ Year 12	☐ Extension 2	Task Number 3

Suggested solutions | **Marker's Feedback**

Multiple-choice

Q1. **B**

$y = 2x^{\frac{1}{3}}$

$x = 2y^{1/3}$, $\therefore \frac{x}{2} = y^{\frac{1}{3}}$

$\therefore y = \frac{x^3}{8}$

Q2: **C**

$b = 2$, $c = -1$, $d = 1$

$y = a(x+2)(x-1)^2(x+1)^3$

when $x = 0$, $y = 4$

$4 = a \times 2 \times 1 \times 1$ $\therefore a = 2$

Q3: **A**

$k^2 - k \neq 0$ and $k^3 - k = 0$

$k(k-1) \neq 0$ and $k(k-1)(k+1) = 0$

$k \neq 0$ or 1 and $k = 0, 1, -1$

$\therefore k = -1$

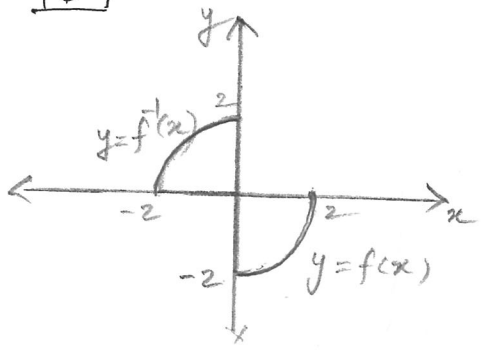
Q4:- **A**

$\sin 25^\circ \cos 20^\circ + \cos 25^\circ \sin 20^\circ = \sin(25+20)$

$= \sin 45^\circ$

$= \frac{1}{\sqrt{2}}$

Q5: **D**



Suggested solutions	Marker's Feedback

Question 6:-

(a) $P(x) = x^4 - x^3 + x^2 - 3x - 6$

i) $P(-1) = (-1)^4 - (-1)^3 + (-1)^2 - 3(-1) - 6$

$= 0$

$P(2) = 2^4 - 2^3 + 2^2 - 3 \times 2 - 6$

$= 16 - 8 + 4 - 6 - 6$

$= 0$

$\therefore x = -1$ and $x = 2$ are zeros of $P(x)$.

(ii) $(x+1)$ and $(x-2)$ are factors of $P(x)$

$(x+1)(x-2) = x^2 - x - 2$ is a factor of $P(x)$ (1)

$$x^2 - x - 2 \overline{)\, x^4 - x^3 + x^2 - 3x - 6} \quad (1)$$

$x^2 + 3$

$x^4 - x^3 - 2x^2$

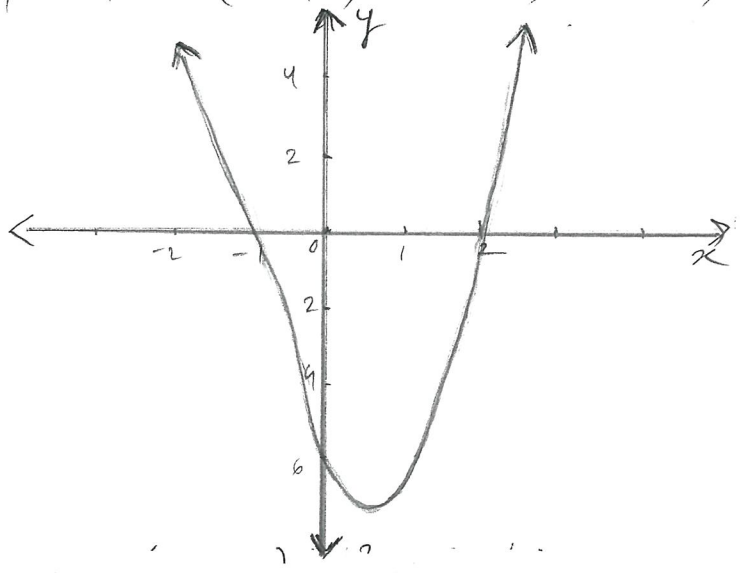
$3x^2 - 3x - 6$

$3x^2 - 3x - 6$

0

$\therefore P(x) = (x+1)(x-2)(x^2+3)$ (1)

(iii)



(iv) $x^4 - x^3 + x^2 - 3x - 6 < 0$

when $-1 < x < 2$ (1)

All students showed working for this question

Well done Grade:

mistakes in long division.

(1)

* Another common mistake is

(1)

$x^2 + 3 = (x + \sqrt{3})(x - \sqrt{3})$

Suggested solutions	Marker's Feedback

6b) $2x^3 - 5x - 3 = 0$

i) $\alpha + \beta + \gamma = 0$ (1)

ii) $\alpha\beta + \alpha\gamma + \beta\gamma = \frac{-5}{2}$ (1)

(iii) $\frac{1}{\alpha^2+\beta^2+\gamma^2} = \frac{1}{(\alpha+\beta+\gamma)^2 - 2(\alpha\beta+\alpha\gamma+\beta\gamma)}$

$= \frac{1}{0 - 2 \times \frac{-5}{2}}$ (1)

$= 5$ (1)

Some got confused and got the wrong answer.

Some used the wrong formula

$\alpha^2+\beta^2+\gamma^2 = (\alpha+\beta+\gamma)^2 - (\alpha\beta+\alpha\gamma+\beta\gamma)$

6c) $x^2 - 5x + 6 = (x-3)(x-2)$

$P(x) = (x^2-5x+6)\phi(x) + 2x+1$

$= (x-3)(x-2)\phi(x) + 2x+1$ } (1)

Remainder $= P(3)$

$= 0 + 2 \times 3 + 1$

$= 7$ (1)

Not showing the working out - properly. They must ~~show~~ write $P(3) = (3^2-5\times3+6)Q(3)+2(3)+1$

Just getting the answer is not going to give them full marks

Suggested solutions	Marker's Feedback

6d)

$P(x) = a(x-2)^2(x-k)(x+k)$

Given that $P(1) = 8$, $P(3) = 80$

$a(1-2)^2(1-k)(1+k) = 8$

$\therefore a(1-k^2) = 8$ ——— (1) (1)

$a(3-2)^2(3-k)(3+k) = 80$

$\therefore a(9-k^2) = 80$ ——— (2) (1)

$(2) \div (1) \Rightarrow \dfrac{9-k^2}{1-k^2} = 10$

$9-k^2 = 10-10k^2$

$9k^2 = 1$

$k^2 = \dfrac{1}{9}$

$k = \pm\dfrac{1}{3}$ (1)

Hard question.

Many solved the equations

$1-k^2=8$ and

$9-k^2=80$

individually which leads to the answer 'no solution'. These equations need to be solved simultaneously to get the answer.

Suggested solutions	Marker's Feedback

Question 7:-

a) $\frac{2x}{1-x} \geq x \qquad x \neq 1$

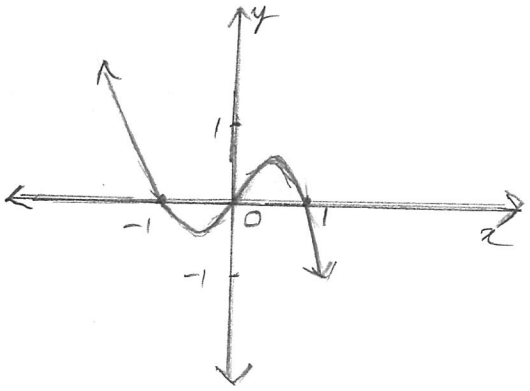
$2x(1-x) \geq x(1-x)^2$ (1)

$2x(1-x) - x(1-x)^2 \geq 0$

$x(1-x)[2-(1-x)] \geq 0$

$x(1-x)(1+x) \geq 0$ } (1)

$-x(x-1)(x+1) \geq 0$



$\therefore x \leq -1$ or $0 \leq x < 1$ (1)

* Some forgot to multiply by $(1-x)^2$.

* No marks for multiplying by $1-x$ as it made the inequality easier to solve

* Many did not pick up that $0 \leq x < 1$

* Many used critical points

Suggested solutions	Marker's Feedback

7b) i) $f(x) = x^2 - 2, \quad 0 \le x \le 4$

Let $y = x^2 - 2 \quad 0 \le x \le 4, \quad -2 \le y \le 14$

For inverse function, swap x and y

$x = y^2 - 2$

$y^2 = x + 2$

$y = \pm\sqrt{x+2}$ (1)

$\therefore f^{-1}(x) = \sqrt{x+2}$ since $0 \le f^{-1}(x) \le 4$ → (1)

Domain of $f^{-1}(x)$ is $-2 \le x \le 14$ (1)

students had to state why $y = +\sqrt{x+2}$ and not $y = -\sqrt{x+2}$ (1) to get 2nd mark

Many wrote D: $x \ge -2$ (no mark)

not done well.

(ii) Point of intersection of $f(x)$ and $f^{-1}(x)$:

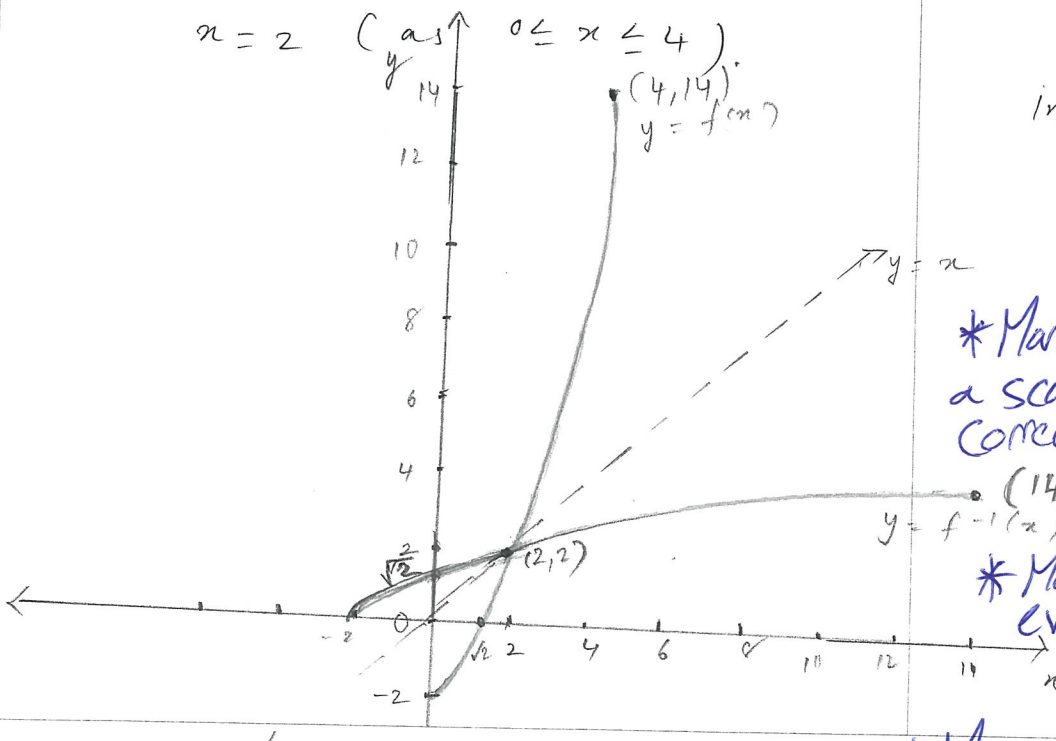
$x^2 - 2 = x$

$x^2 - x - 2 = 0$

$(x-2)(x+1) = 0$

$x = 2$ or $x = -1$

$x = 2$ (as $0 \le x \le 4$)



POI → 1 mark

intercepts → 1 mark

shape → 1 mark

end points

* Many sts did not include a scale or use a correct scale on their axes.

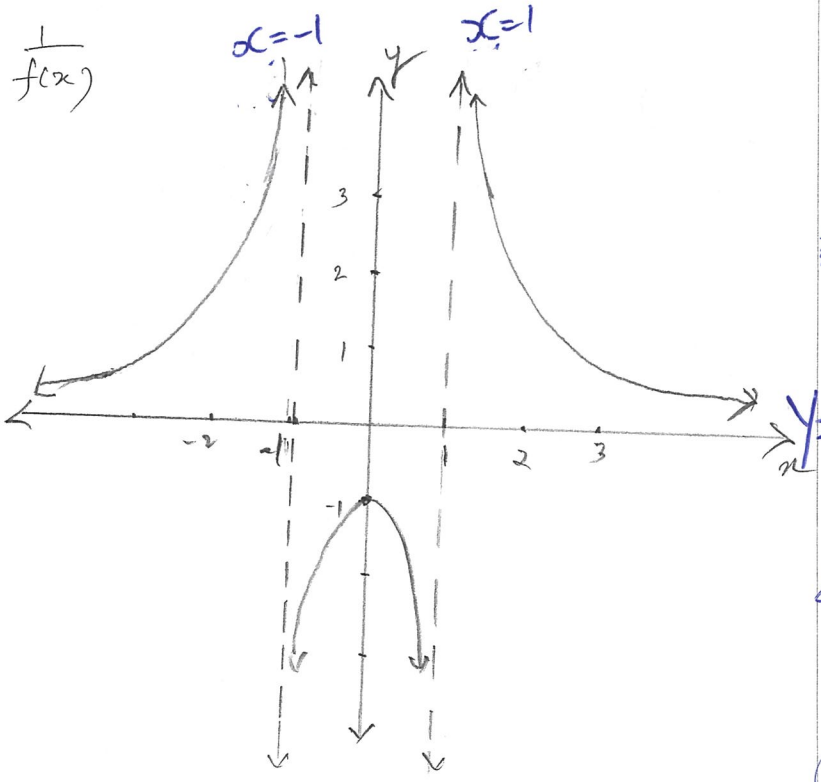
* Many did not label everything that was asked for

* Many drew straight lines, the graphs are curved.

Suggested solutions	Marker's Feedback

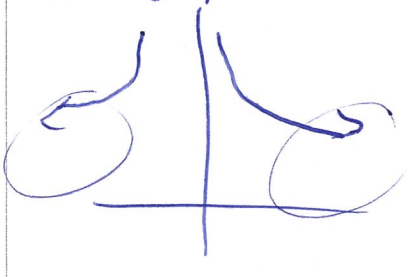
(c) $f(x) = x^2 - 1$

$y = \frac{1}{f(x)}$



Asymptotes → 1
Turning point → 1
Shape → 1

*To get full marks sts must have labelled all asymptotes y=0 *Many left out y=0 as an asymptote & had graphs like



or



(c) *was marked strictly

(d) $x = 5\cos 2t + 1$

$y = 5\sin 2t - 1$

$\cos 2t = \frac{x-1}{5}$, $\sin 2t = \frac{y+1}{5}$ (1)

$\cos^2 2t + \sin^2 2t = 1$

$\frac{(x-1)^2}{25} + \frac{(y+1)^2}{25} = 1$

$(x-1)^2 + (y+1)^2 = 25$ (1)

(d) A lot of sts used double angle formula & got nowhere otherwise *done well

Suggested solutions	Marker's Feedback

Question:-8

(a)

(i) $8! = 40320$ (1)

(ii) $3!\,4! = 144$ ways (1) (1)

(iii) First adult can pair with 4 children.
Second adult can pair with 3 children
Third adult can pair with 2 children
Fourth adult can pair with 1 child.
$\therefore 4! = 24$ ways. (1)

well done.

generally done well

Done reasonably well.

(b) i) ${}^{11}C_5 = 462$ (1)

(ii) 6 Men and 5 women.

Options are 3M 2W, 4M 1W, 5M

Total no. of ways $= {}^6C_3 \times {}^5C_2 + {}^6C_4 \times {}^5C_1 + {}^6C_5$ (1)

$= 200 + 75 + 6$

$= 281$ (1)

Quite well done

some students did not consider committee with all five men.

(c) (i)

Total arrangements $= \frac{6!}{2!\,4!}$

$= 15$ (1)

Done reasonably well.

(ii) Options are

(1)
- 4W 0B $= 1$
- 3W 1B $= \frac{4!}{3!} = 4$
- 2W 2B $= \frac{4!}{2!\,2!} = 6$

Total arrangements $= 11$ (1)

A significant number of students made one error and received 1 out of 2.

Suggested solutions	Marker's Feedback

8d)

i) Total arrangement $= (n-1)!$ (1)

Done really well

ii) $P(3 \text{ people together}) = \dfrac{3!\,(n-3)!}{(n-1)!}$ (1)

must consider probability to get first mark

[No marks for $3!(n-3)!$]

$= \dfrac{6\,(n-3)!}{(n-3)!\,(n-2)(n-1)}$

(1)

$= \dfrac{6}{(n-1)(n-2)}$

1 mark for simplifying

[Paid if left numerator as $3!$ and all else simplified]

Suggested solutions	Marker's Feedback

Question 9:-

a) There are 4 pairs that give a total of 12

i (2, 10) (3, 9) (4, 8) (5, 7)

1 and 6 do not have a pair to give a total of 12.

If the first six numbers chosen are 1, 2, 3, 4, 5 or 6, then no sum of 12 will be formed. 7th number will form a pair.

∴ Will need to choose 7 players.

(1) for correct answer.
(1) for explanation.

To get full marks students must demonstrate how they got the answer.

Generally well done.

(1)

b) $(2a-b)^4 = (2a)^4 + \binom{4}{1}(2a)^3(-b) + \binom{4}{2}(2a)^2(-b)^2 + \binom{4}{3}(2a)(-b)^3 + (-b)^4$

$= 16a^4 + 4 \times 8a^3 \times -b + 6 \times 4a^2b^2 + 4 \times 2a \times -b^3 + b^4$

$= 16a^4 - 32a^3b + 24a^2b^2 - 8ab^3 + b^4$ — (1)

well done.

Suggested solutions	Marker's Feedback

9 c)

General term is $\binom{8}{k}(x^2)^{8-k}\left(\frac{1}{2x}\right)^k$

$$= \frac{\binom{8}{k}}{2^k} \times \frac{x^{16-2k}}{x^k}$$

$$= \frac{\binom{8}{k}}{2^k} x^{16-3k} \quad (1)$$

Generally well done

$16 - 3k = 1$

$k = 5 \rightarrow (1)$

$\therefore$ Coefficient of $x = \frac{\binom{8}{5}}{2^5}$

$= \frac{56}{32}$

$= \frac{7}{4}$ (1).

d) ci) $(1+x)^n = \binom{n}{0} + \binom{n}{1}x + \binom{n}{2}x^2 + \cdots + \binom{n}{n}x^n$ (1)

Generally well done.

(ii) Substitute $x = 1$ in (1) (1)

$(1+-1)^n = \binom{n}{0} + \binom{n}{1}x-1 + \binom{n}{2}(-1)^2 + \cdots + \binom{n}{n}(-1)^n$

$\binom{n}{0} - \binom{n}{1} + \binom{n}{2} - \cdots + \binom{n}{n}(-1)^n = 0$

$\therefore \binom{n}{0} + \binom{n}{2} + \binom{n}{4} + \cdots = \binom{n}{1} + \binom{n}{3} + \binom{n}{5} + \cdots$

(1)

Suggested solutions	Marker's Feedback

9 e)

$$(1+2x)^n = \sum_{k=0}^{n} \binom{n}{k} 1^{n-k} (2x)^k$$

$$= \sum_{k=0}^{n} \binom{n}{k} 2^k x^k$$

Coefficient of x^4 is $\binom{n}{4} 2^4$

Coefficient of x^6 is $\binom{n}{6} 2^6$

$$\frac{\binom{n}{4} 2^4}{\binom{n}{6} 2^6} = \frac{5}{8} \quad (1)$$

Common error

$$8\binom{n}{4} 2^4 = 5\binom{n}{6} 2^6$$

$$\frac{\frac{n!}{4!(n-4)!}}{\frac{n!}{6!(n-6)!} \times 2^2} = \frac{5}{8}$$

$$\frac{6!\,(n-6)!}{4!\,(n-4)! \times 4} = \frac{5}{8}$$

Common error

$$\frac{(n-4)!}{(n-4)!\,(n-5)(n-6)}$$

$$\frac{6 \times 5}{(n-4)(n-5)} = \frac{5}{8}$$

$$(n-4)(n-5) = 12$$

$$n^2 - 9n + 20 - 12 = 0$$

$$n^2 - 9n + 8 = 0 \quad (1)$$

'n' must be a positive integer.

$$(n-8)(n-1) = 0$$

$$n = 8 \text{ or } n = 1$$

$n = 8$ (as $n = 1$ produces no x^4 or x^6 terms)

$\Rightarrow (1)$ must exclude $n = 1$ to get full marks

no carry forward error if the answer is not a positive integer

Suggested solutions	Marker's Feedback

Question 10 :-

a) $\sin 75^0 = \sin(30^0 + 45^0)$ (1)

$= \sin 30 \cos 45^0 + \cos 30^0 \sin 45^0$

$= \frac{1}{2} \times \frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}}$ (1)

$= \frac{1+\sqrt{3}}{2\sqrt{2}}$

Well done.

(b) $t = \tan \frac{\theta}{2}$

$LHS = \frac{\sin \theta}{1 + \cos \theta}$

$= \frac{2t}{1+t^2} \div \left[1 + \frac{1-t^2}{1+t^2}\right]$ (1)

$= \frac{2t}{1+t^2} \div \left[\frac{1+t^2+1-t^2}{1+t^2}\right]$

Well done.

$= \frac{2t}{1+t^2} \times \frac{1+t^2}{2}$

$= t$ (1)

$= RHS$

Suggested solutions	Marker's Feedback

10 c)

$$\text{LHS} = \frac{\cos x - \cos(x+2y)}{2\sin y}$$

$$= \frac{\cos x - \cos x \cos 2y + \sin x \sin 2y}{2\sin y}$$

$$= \frac{\cos x - \cos x(1 - 2\sin^2 y) + \sin x \times 2\sin y \cos y}{2\sin y} \quad (1)$$

$$= \frac{\cos x - \cos x + 2\cos x \sin^2 y + 2\sin x \sin y \cos y}{2\sin y}$$

$$= \frac{2\cos x \sin^2 y + 2\sin x \sin y \cos y}{2\sin y}$$

$$= \frac{2\sin y(\cos x \sin y + \sin x \cos y)}{2\sin y} \quad (1)$$

$$= \sin x \cos y + \cos x \sin y$$

$$= \sin(x+y) \quad (1)$$

$$= \text{RHS}$$

Some students had trouble with this question.

Suggested solutions	Marker's Feedback

10 d) LHS $= \sin 3\theta$

$= \sin(2\theta + \theta)$

$= \sin 2\theta \cos\theta + \cos 2\theta \sin\theta$ (1)

$= 2\sin\theta \cos\theta \cos\theta + (1 - 2\sin^2\theta)\sin\theta$

$= 2\sin\theta \cos^2\theta + \sin\theta - 2\sin^3\theta$ (1)

$= 2\sin\theta(1 - \sin^2\theta) + \sin\theta - 2\sin^3\theta$

$= 2\sin\theta - 2\sin^3\theta + \sin\theta - 2\sin^3\theta$

$= 3\sin\theta - 4\sin^3\theta$ (1)

$=$ RHS

Generally well done

(e) i) $(a+b)(a^2 - ab + b^2) = a^3 - a^2b + ab^2 - a^2b - ab^2 + b^3$ (1)

$= a^3 + b^3$

Well done

(ii) $\cos^6\theta + \sin^6\theta = (\cos^2\theta)^3 + (\sin^2\theta)^3$

$= (\cos^2\theta + \sin^2\theta)(\cos^4\theta - \cos^2\theta\sin^2\theta + \sin^4\theta)$ (1)

$= \cos^4\theta - \cos^2\theta\sin^2\theta + \sin^4\theta$ (as $\cos^2\theta + \sin^2\theta = 1$)

$= (\cos^2\theta + \sin^2\theta)^2 - 3\cos^2\theta\sin^2\theta$ (1)

$= 1 - \frac{3}{4}(2\sin\theta\cos\theta)^2$

$= 1 - \frac{3}{4}\sin^2 2\theta$

$= 1 - \frac{3}{4}[1 - \cos^2 2\theta]$

$= \frac{1}{4} + \frac{3}{4}\cos^2 2\theta$ (1)

Some students couldn't finish the proof.

Suggested solutions	Marker's Feedback

Question 11:—

a) $LHS = \dfrac{\sin 2A}{\sin A} - \dfrac{\cos 2A}{\cos A}$

$= \dfrac{2\sin A\cos A}{\sin A} - \dfrac{(2\cos^2 A - 1)}{\cos A}$ — ① ①

$= 2\cos A - \dfrac{2\cos^2 A}{\cos A} + \dfrac{1}{\cos A}$

$= 2\cos A - 2\cos A + \sec A$ — ①

$= \sec A$

$= RHS$.

A lot of variations

$= \dfrac{\sin 2A\cos A - \cos 2A\sin A}{\sin A\cos A}$

$= \dfrac{\sin(2A - A)}{\sin A\cos A}$

$= \dfrac{\sin A}{\sin A\cos A}$

was a good proof too.

(b) $4x^2 - 3x - 3 = 0$

$\tan A + \tan B = -\dfrac{b}{a} = \dfrac{3}{4}$ ①

$\tan A \tan B = \dfrac{c}{a} = \dfrac{-3}{4}$ ①

$\tan(A+B) = \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$

$= \dfrac{3/4}{1 + 3/4}$

$= \dfrac{3}{7}$ ①

Many students found

$\tan A = \alpha = \dfrac{3 \pm \sqrt{57}}{8}$ & $\tan B = \beta = \dfrac{3 \mp \sqrt{57}}{8}$

then found $\tan(\alpha + \beta)$.

Students who found the wrong values for α & β, but then used them correctly could get 2 mark for Error Carried Forward.

One bad mistake

$\tan\left(\dfrac{3+\sqrt{57}}{8}\right) + \tan\left(\dfrac{3-\sqrt{57}}{8}\right)$

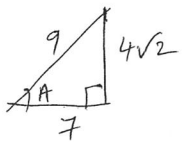
is BAD.

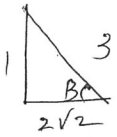
$\dfrac{3+\sqrt{57}}{8}$ is $\tan\alpha$.

This got 0 mark.

Suggested solutions	Marker's Feedback

10 c)





No marks for finding cos B or sin A. (but OK to use)

$\sin B = \frac{1}{3}$, $\cos B = \frac{2\sqrt{2}}{3}$, $\sin A = \frac{4\sqrt{2}}{9}$

BEST WAY.

$\therefore \sin B = \frac{1}{3}$.

$\sin 2B = 2 \sin B \cos B$

$= 2 \times \frac{1}{3} \times \frac{2\sqrt{2}}{3}$ 1 Still valid & full mks.

$= \frac{4\sqrt{2}}{9}$ 1

$= \sin A$

$\cos 2B = 1 - 2\sin^2 B$ 1

$= 1 - 2\times(\frac{1}{3})^2$

$= \frac{7}{9}$ 1

$= \cos A$

As $\cos A = \cos 2B$,
A, B in Q_1,
$A = 2B$.

$\therefore A = 2B$

One REALLY BAD mistake which led to NO mks: $B = 19°28'$, $A = 38°57'$, $A = 2B$.
THIS IS COMPLETELY WRONG & GETS 0 MARKS → A could = 2.00018 or 1.9998.

d) $\cos 2\theta = -2\sin^2\theta - \sin 2\theta$

$\cos^2\theta - \sin^2\theta = -2\sin^2\theta - 2\sin\theta\cos\theta$ (1)

A lot of silly mistakes.

$\cos^2\theta + 2\sin\theta\cos\theta + \sin^2\theta = 0$

$(\cos\theta + \sin\theta)^2 = 0$

$\cos\theta + \sin\theta = 0$ (1)

I did allow
$2\sin\theta\cos\theta = -1$
$\sin 2\theta = -1$
$2\theta = 270°, 630°$
$\theta = 135°, 225°$
$\tan\theta = -1$.

$\cos\theta = -\sin\theta$.

$\therefore \tan\theta = -1$ $(\div \cos\theta)$

(1)

Suggested solutions	Marker's Feedback

11 e)

$$4\cos 4x \cos 2x \cos x = 2\cos 4x \cos 2x \times 2\cos x.$$

$$= \left[\cos(4x+2x) + \cos(4x-2x)\right] 2\cos x \quad (1)$$

$$= \left[\cos 6x + \cos 2x\right] 2\cos x$$

$$= 2\cos 6x \cos x + 2\cos 2x \cos x$$

$$= \cos(6x+x) + \cos(6x-x)$$

$$+ \cos(2x+x) + \cos(2x-x) \quad (1)$$

$$= \cos 7x + \cos 5x + \cos 3x + \cos x.$$

Generally quite well done, although some students got halfway & couldn't finish it.

END OF SOLUTIONS